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FARMERS' EXPERIENCES WITH KOCHIA AS A FEED

BY

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FARMERS' EXPERIENCES WITH KOCHIA AS A FEED

A FARM SURVEY OF

- Soil Salinity Problems
- Cropping Systems Approach - Saline Soils
- Kochia Management - Saline Soil
- Livestock Feeding Experiences Using Kochia

AMONG

SOUTHERN SASKATCHEWAN FARMERS

1987

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SUMMARY

Farm Survey 1987

Kochia production on saline soil and its usage as a forage for livestock in southern Saskatchewan

- 54 farmers at 39 different geographic locations across southern Saskatchewan were involved in the survey.
- Sampling of each of the above farmers indicated that several other livestock producers in their area had also been involved in harvesting and feeding kochia.
- In nearly 100% of cases, kochia is growing as a volunteer crop in saline areas of cultivated and cereal seeded fields.
- Kochia is not generally considered a serious problem in the balance of cultivated fields that are not saline. The Weyburn area in 1987 was an exception.
- Soil disturbance using some method of cultivation appears to be essential to bring on germination and growth of an acceptable stand of kochia.
- Where kochia starts growth late in saline areas (usually with the arrival of hot weather and after showers in June) it overtakes the cereal crop (usually wheat or barley) and represents 75-90% of the crop stand by harvest.
- Where kochia occurs in smaller saline patches it is swathed along with the cereal crop, not combined but left until after harvest. It is then disposed of by baling, chopping or foraged by cattle doing stubble grazing. Kochia at this stage is often too mature and does not make ideal feed, although cattle still eat it, especially if it is put through a mix mill or a tub grinder.

- Many farmers are trying extended or continuous cropping on fields that have considerable salinity. These fields are worked, fertilized and seeded (usually to barley) and consistently produce a stand of healthy, vigorously growing kochia in the saline areas.
- Some farmers are harvesting these areas of kochia at an earlier stage (near to or shortly after flowering), when the stand is less stalky and close to ideal as a forage for feeding purposes.
- It is an absolute must to put kochia harvested at the early stage through a crusher-crimper unit in order to get the swath to dry. Even with this treatment drying or curing may take 5-10 days.
- The majority of farmers bale kochia up into large round bales and feed it free choice in feeders, using an electric wire, or roll it out on the ground.
- Nearly all kochia is being fed along with cereal straw, tame and slough hay, with some grain during cold weather and before and after calving. Kochia as a part of the ration varies from about 10-50%.
- Not a single farmer interviewed has had any livestock losses attributed to feeding kochia hay. They have also not encountered any illness that they consider has arisen from feeding kochia.
- The bulk of use of kochia as a forage has been to wintering pregnant beef cows.
- Palatability is not a problem when kochia is harvested at an early stage. It is often preferred to other feed. The problem of intake is limited to kochia harvested in the mature, stalky stage and not processed prior to feeding.
- No calving problems or weak calves have resulted where kochia has been fed. Rather, strong, healthy calves have been the rule.

- Farmers have some concern over the length of time needed to dry and cure swaths of kochia, especially where it has been swathed and not crushed or crimped.
- Where weeds other than kochia are present farmers have reported some spoilage in large round bales when baled before well cured. This has not been a widespread problem and kochia can apparently be baled at higher moisture than alfalfa without spoilage.
- Nearly all farmers who have fed kochia were positive in their decision to continue using it as a forage when available.
- They are strongly supportive of further research into the potential for kochia:

. as soil improver in saline soils,

. as a companion crop with other saline tolerant crop such as sweet clover,

. as an ideal forage for silage,

. as a possibility for spring, summer and fall pasture use,

. to develop a leafier, less stalky plant, more palatable at later harvested stage,

. the use of preservatives to allow earlier baling and reduce spoilage in large round bales,

. to carry out livestock feeding trials to determine its relative usefulness as a forage to various classes of livestock,

. to make available more information and research that will give reassurance and legitimacy to its use as a livestock feed.

FARMER TRIALS AND EXPERIENCE WITH KOCHIA ON SALINE SOILS IN SASKATCHEWAN

INTRODUCTION

Southern Saskatchewan has suffered serious drought conditions over a number of years, most recently during the 1980's. In order to maintain basic livestock herds, large quantities of varying types of forage were trucked into the area at high cost both from within and beyond the province. Livestock numbers dropped significantly during this period, as many farmers not totally dependent upon livestock production for their livelihood chose to liquidate their entire herd rather than absorb financial loss due to very high feed costs.

It became evident through contact with farmers during this time that some livestock producers had turned to harvesting and feeding kochia to their wintering cow herds. This kochia was growing as a wild plant on saline acreage on their farm which no longer produced other than a marginal crop of cereal in favorable years and no crop in bad years. The success of feeding wild kochia as a portion of the forage ration, harvested from what might be considered waste land, prompted investigation of this plant as a possible forage source to southern Saskatchewan farmers.

A decision was made to interview livestock producers in southern Saskatchewan who had been harvesting and feeding kochia, in order to document as much information as possible regarding their experiences in growing, harvesting and feeding kochia as a substitute forage to livestock.

METHODS

An extensive questionnaire (see Appendix) was developed and utilized through personal interviews with farmers who had harvested and fed kochia taken from areas on their farm or neighbors with serious salinity problems and on which wild kochia was the only crop being produced.

The survey attempted to cover areas across southern Saskatchewan where salinity was a problem. It involved 54 farmers from the following geographic locations: Tugaske, Eyebrow, Weyburn, Tribune, Radville, Briercrest, Hearne, Avonlea, Parry, Estevan, Shamrock, Morse, Hodgeville, Ernfold, Swift Current, Webb, Success, Cabri, Fox Valley, Cadillac, Admiral, Shaunavon, Eastend, Mossbank, Spring Valley, Woodrow, and Schuler and Warner, Alberta.

In order to obtain a broadly representative sample, only a few farmers were interviewed at any one geographic location. It became evident, however, that there were more farmers in any one area who were also feeding some kochia to their livestock herds. In addition, there are many other areas with serious salinity problems which were not surveyed but where some kochia is also being fed to livestock on a trial basis.

The following is a summary of responses to questions in the survey questionnaire and reflects the experience that farmers have had with salinity problems and the utilization of kochia which has grown on these areas.

RESULTS

1. Type of Operation

- of the farmers interviewed, approximately 5% were in grain production only, with 95% in grain-livestock operations.

- 87% were in cow-calf operations of which 30% also were involved in a feeder operation.

2. Land Base

Cultivated land base ranged from 100 acres to 3500 acres, with uncultivated, represented in native and tame hay and pasture, ranging from 50-3600 acres.

3. Degree and Development of Salinity

The degree of severely saline acreage growing kochia or other weeds ranged from 10 to 300 acres with an average of 40 acres.

Acreage categorized as severely saline, but on which farmers were able to establish some grass cover, ranged from a low of 5 acres to a high of 500 acres, with the average at approximately 40 acres.

Acreage classed as moderately saline, on which there was reduced production of cereals, ranged from 5-450 acres with an average of 117 acres.

The development of saline acreage in the sample farms were reported as 48% having occurred prior to 1950, with 62% reporting that they had a combination of prior salinity and a significant increase in saline acreage from 1950-87.

4. Nature and Location of Saline Sites

Approximately 18% of farmers surveyed indicated their salinity problems were largely centred around potholes in their fields, with a small percentage reporting problems on hills, side slopes and in sandy soil.

16% reported salinity problems in smaller basin areas with 66% identifying their problem areas as low lying land, much of which was subject to periodic flooding.

5. Pattern of Cropping

32% of farmers sampled reported they were on a 1/2 and 1/2 basis (50% crop - 50% smf) of cropping.

24% indicated a 1/3 - 2/3 crop - summerfallow rotation with 52% reporting varying approaches to extended cropping. Among all groups there was indication of more continuous cropping on the saline acreage.

6. Cereals Grown on Saline Sites

Production of a range of cereals had been tried on farmers' saline sites. Barley rated 56%,; oats 22%, durum wheat 6%, spring wheat 22%, rye 4% and winter wheat 4%.

In a majority of cases the saline areas were seeded with the same crop as the surrounding field area when spring seeding operations were under way.

7. Forage Grown on Saline Sites

40% of farmers interviewed had been involved with sweetclover production on saline areas with varying degrees of success.

10% had encountered mixed success with establishing grass on these sites while 8% had attempted to establish stands of alfalfa again with varying success.

8. Cropping Success and Cultivation Problems of Saline Sites

28% indicated failure in cropping their saline areas, while 54% had encountered partial and limited success in cropping this acreage. The remainder were troubled with flooding and wet soil conditions.

Timing of cultivation was critical for the majority of farmers in the sample, although a number were able to work their saline acreage along with the balance of the field. Areas subject to flooding invariably had to be worked separately.

9. Consistency of Kochia Growth on Saline Sites

64% of farmers indicated that kochia grew quite consistently on their saline acreage, with 32% indicating that their stands of kochia tended to be quite variable from year to year. Most consistent stands were off field areas that were saline and received regular soil disturbance, but these stands often showed substantial variation in vigor and growth throughout the saline areas.

10. How Farmers Had Dealt With Kochia Problems on Their Saline Soil Areas

92% had harvested at least a portion of their kochia for feed or had made it available to neighbors to harvest. Considerably less than half had harvested kochia for feed at the ideal stage but had baled it up from the swath at mature stage after harvest.

28% reported they had swathed their kochia and worked it back into the saline soil areas.

20% indicated they simply put kochia swaths through the combine when the rest of the crop was harvested thus returning it back into the saline areas.

A small number reported swathing it with the crop, not combining it and burning it after harvest.

11. Was Kochia Controlled in the Crop by Spraying?

60% of those responding indicated that kochia had been controlled in their cropland by spraying.

16% indicated lack of control through the normal cereal spraying operation.

12% reported only partial control that varied from year to year.

12. Chemicals Used on Cereal Crop and Kochia Areas

72% of farmers interviewed indicated they had relied primarily on 2-4-D for their weed control including the kochia areas.

20% has also used Banvel with 2-4-D to achieve more effective control. About 10% of farmers had turned to using Glean to control their kochia areas while a small percentage had also tried Hoegrass, Stampede, Torch, Tordan and Treflan in their weed control program.

13. Degree to Which Kochia was a Problem in Their Grain Crop Other Than on the Saline Areas

10% of farmers reported that kochia was a problem to them throughout their grain crops. This appeared to be on those soils where salts and pH readings tended to be high throughout much of the field areas. The problem tended to vary in severity from one year to the next.

80% however, indicated that they did not consider kochia a serious weed problem in their normal cropland but that it was mainly limited to their saline acreage.

Kochia in normal crop stands did not appear to compete, but tended to germinate late in the spring after rain, making rapid growth in the high salt areas where production of seeded cereals was most restricted.

14. Grazing of Kochia Stands as Pasture

40% of respondents indicated no experience with grazing kochia.

26% had been mainly involved with livestock grazing late growing kochia off swathed cereal fields that had been harvested and where cows

were grazing and foraging swaths of mainly kochia left in the field and not combined.

10% of responding farmers indicated they had utilized kochia for spring and summer pasture. After livestock has become used to it they had not had trouble with acceptance or palatability. In fact, some reported their livestock preferred it where they were able to graze it in the early growth stages.

Of those who had experience with grazing, none reported any losses of livestock that could be attributed to kochia. They did report some problem with excessive looseness of stools. Two farmers reported loss of livestock with late fall grazing after snow fall but were uncertain as to the causes of death.

15. Occurrence and Propagation of Kochia Stands

96% of farmers indicated that their kochia stands were natural occurring stands and had not been seeded stands. Where stands had been seeded, seed of recognized quality had been purchased. Various methods of seed bed preparation and seeding methods had been used with varying degrees of success.

In very nearly all cases, kochia has been grown on saline soil that was restrictive for cereal production. The majority of farmers interviewed carry out normal spring cultivation for seed bed preparation and seed cereal through the saline area if it is dry enough at the time to do so. Depending upon growing conditions in the spring and early summer period, the cereal crop in the saline area will attempt to establish under stressed conditions. It is overtaken later in the season by the vigorous and competitive crop of kochia which has volunteered and begun growth much later in the season.

In some cases, farmers have been successful in removing the young kochia with herbicide but more often it is not removed when normal cereal spraying is done.

The most consistent stands of kochia growing every year are on those saline areas in cultivated fields that are subject to cultivation and soil disturbance each year.

Farmers reported that their kochia problem was associated with problem soils, primarily salinity, and that they did not view it as a serious problem on their normal non-saline crop land.

16. Location of Salinity Problems

28% of interviewees reported that their salinity problems occurred in potholes or smaller patches in their cultivated fields.

56% indicated salinity problems were located in lower lying land representing portions of cultivated fields.

4% reported salinity on light sandy soil, with the balance occurring on native or seeded pasture, or hay land.

17. Cropping Patterns and Kochia Occurrence on Saline Areas

With few exceptions farmers were working up saline areas in field situations and seeding them to cereals, i.e., wheat, barley, oats, along with regular spring operations. Low lying saline area subject to flooding were cultivated and seeded later. Depending upon weather conditions and moisture, cereals planted in saline areas would make varying degrees of establishment until stress of heat, high salts and drought would severely restrict their growth, and bring on the rapid growth of volunteer kochia.

Depending upon the season, the ultimate yield of crop in these areas could range from a low of 0% cereal - 100% kochia, to a 75-90% stand of kochia.

The use of fertilizer varied considerably and fertilizer applied to saline areas was generally that formulation of nitrogen-phosphorous used on the field area.

40% reported using fertilizer of either nitrogen, phosphorous or both in formulation. 4% reported application at high rates of barnyard manure into the saline spots in their fields.

18. Characteristics of Kochia Stands

Wide variations were reported in the nature of the volunteer stands of kochia taken from saline areas. This varied from dense thick tall growing stands of good green color, to patches of stunted yellowish green stands carrying high plant populations. Growth patterns tended to be very erratic within given saline areas with variation of stands reported from one year to another. The inconsistency of production of desirable quality kochia material was an area of concern among a number of those farmers in the survey.

19. Weed Problems in Kochia Stands

Generally weeds were not a problem in the saline area taken over with kochia. Those that did occur in a few cases were wild barley, sow thistle, French weed, quack grass and red root pigweed. The competitive nature of kochia in saline sites appears to displace other weed growth.

20. Harvesting Methods and Yields of Kochia

52% of farmers in the sample were using equipment that would crush and crimp kochia stands after cutting. 36% reported using conventional

swathers for harvesting kochia stands. The balance were using chopper approach for silage or stacker harvesting.

46% reported using large round bales whereas 34% were continuing to use small square bales for handling and feeding, as well as large round bales. The majority of farmers indicated that they were harvesting their kochia for feed at too mature a stage, when it was already coarse and stalky, causing considerable loss in feeding, unless bales were first processed. A small percentage were harvesting at or before flowering, which provided forage at its optimum feeding value. A substantial number were swathing kochia sites along with cereal harvest, and baling for feed after the cereal crop was combined.

Drying time for kochia in the swath, unless it had been cut with a hay conditioner, was considered excessive, running from 10 to 30 days and varied with weather conditions, size of swath, etc. Most successful handling had been that of using a hay conditioner, with a smaller cut, and cutting fairly high stubble to promote better drying. Most farmers felt they had been able to save a good percentage of leaves and seed by baling when forage was tough.

They also were of the opinion that kochia in the swath weathered well and did not deteriorate seriously with rain. Mold and spoilage in the swath or bale did not appear to be a serious problem, and a few producers felt they were able to bale kochia at higher moisture levels without spoilage than some other forages.

Yields of kochia harvested for forage were reported to average from approximately 1 to 3 tons per acre.

21. Locations from Which Kochia Was Harvested

92% of respondents indicated that they had harvested kochia for feed from saline areas on their own farm.

52% stated that they had also harvested kochia offered to them by neighbors who were not in livestock but had areas on their farm that were saline and producing kochia. In the majority of cases, they were harvesting kochia off neighbors fields for which they were paying a minimum or no charge for removing and utilizing it for livestock feed.

22. Consistency of Kochia Growth Year After Year

48% reported quite consistent growth of kochia year after year.

46% reported great variability and inconsistency in kochia stands year after year.

A number of farmers suggested that perhaps the annual application of herbicide over their fields including their saline areas was adding to the erratic occurrence of kochia stands by removing it with herbicides. They also pointed out that kochia stands were also not present where flooding continued well into the growing season.

23. Cultivation of Saline Areas

In nearly all cases farmers reported that they carried out normal spring cultivation through their saline areas at the same time as they were doing spring cultivation and seeding.

Only when the saline areas were wet or flooded would they be worked and seeded later.

24. Grassing Saline Areas

Approximately 50% of farmers had attempted to establish grass on their saline areas. Of these, 40% reported failure in getting grass or alfalfa established due to drought, wild barley, kochia, quack grass and

grasshopper problems. 6% reported partial success, with 2% indicating satisfactory establishment.

25. Cropping Practices on Saline Acreage

Approximately 25% have utilized continuous or extended cropping but report variable results with some improvement showing in the saline areas.

A small percentage have tried growing sweetclover on these sites but have generally had poor results.

Barley has been the preferred cereal in the continuous cropping effort of some producers.

26. Growing Kochia with Another Crop

In nearly all cases farmers were seeding a cereal crop only. In the saline areas kochia emerged later as a volunteer crop. Depending upon the season, the percentage of crop versus kochia could vary substantially. In the majority of cases, however, by season's end kochia would predominate and would represent the bulk of growth in the saline sites.

27. Livestock Feeding of Kochia

90% of those interviewed indicated they had fed kochia to their wintering bred beef cow herd.

20% had also fed kochia as a part of the ration to their feeder cattle and calves. 8% indicated having also fed kochia to their bred heifers.

28. Percentage of Fed Ration Representing Kochia, Hay, Straw, Grain

30% of farmers reported feeding kochia at a level of 20% or less of the ration. 38% were feeding it as at level between 20-40% and 24% were feeding it between 40-50% of the daily ration.

There was wide variation in the components of the balance of the ration. The majority were using hay, ranging from tame hay, alfalfa, sweetclover, slough hay, and straw. A fair percentage were also supplementing grain in the ration, that mainly being feed barley.

29. Method of Feeding

The majority were feeding on a free choice basis but a surprising number were processing the feed base with a hammer mill, tub grinder etc. and a few were feeding with an electric wire. In a majority of cases straw was available free choice and as bedding, with kochia and hay being fed in feeders, free choice or as part of the prepared ration.

30. Acceptability of Kochia by Livestock

Almost without exception, farmers reported good acceptance and palatability of kochia by livestock as part of the ration, where it had been harvested early and was not coarse or stalky. When harvested in an over mature stage, and fed free choice, wastage was evident due to the coarse nature of much of the kochia. However, when this material was processed to break down these stalks, livestock increased their intake of it considerably. There appeared to be some preferential difference for the normal green kochia stand as against the stunted yellow stands that appear in much of the volunteer kochia that is harvested.

31. Digestive Problems Related to Feeding of Kochia

There appeared to be no feeding or digestive problem where kochia was fed up to 50% of the ration. Where the level approached 50% there was evidence of some looseness of stools, but not to a degree of diarrhea, unless the kochia level rose to a very high percentage of the ration.

Farmers indicated that where they encountered loose bowel movement, it was corrected by increasing the input of straw in the ration. It was also noted by one producer that he had not had any problem with straw impaction after he had begun feeding kochia as a part of the ration.

32. Livestock Losses Attributed to Feeding of Kochia

Of the farmers interviewed, none reported loss of animals that was attributed to the feeding of kochia. There were two farmers who reported having lost some animals where they were involved in late fall and early winter grazing. Although some of the forage being grazed was kochia there was no firm evidence to indicate that kochia had been involved in the mortalities.

33. Feeding Problems Associated with Kochia

82% of farmers in the sample indicated they had not encountered any serious feeding problems with kochia. Some indicated a palatability problem initially getting cattle started on it, but once they were on it there was not further problem.

In fact, some farmers indicated that their livestock were showing preference to kochia over other feeds in the ration.

10% indicated some problem in feeding where the kochia had been harvested too late and was coarse and stocky and was being fed free choice without further processing.

34. Feed Analysis of Kochia Samples

The majority of farmers had not had any feed analysis carried out on the kochia they were feeding. Of those who had submitted samples to the feed testing laboratory (University of Saskatchewan) for analysis, the protein levels had ranged from a low of 8% to a high of 17% with the majority ranging from 11-14%.

Very few farmers had any information regarding the energy level (TDN) of their kochia, but the majority reported that their wintering cow had come through the winter in good condition. Quite a number of those feeding kochia had also been feeding grain, mainly barley, during the cold weather, which had added to the energy level of the ration.

35. Calving Performance

Another observation made by producers was that their cows had calved out good, strong, healthy calves, and that calving problems had been no more than normal.

36. Kochia Harvested and Fed as Silage

There was very limited experience, among producers contacted, who had harvested kochia as silage. Where it had been fed from a bunker silo, the acceptability had been good, but there was some concern that the energy level was low. One farmer had put up kochia with barley as silage, and planned to feed barley and kochia in a ration that would yield silage of the desired T.D.N. and protein to meet feeding requirements of his feeder operation.

Mainly because of curing problems, a number of farmers felt that silage would be a preferable way to handle and feed kochia. For the majority, however, the present equipment available will likely dictate swathing and baling as the major way of putting up kochia as livestock feed.

37. The Use of Kochia in Future Feeding Programs

74% of farmers interviewed indicated that they would definitely be utilizing kochia in the feeding ration to their livestock in future. The majority indicated they would use it as a mixture, and wanted to

grow another crop that would represent a reasonable volume when grown and harvested, along with the kochia.

A few respondents expressed concern that supply was not always available each year due to inconsistency of growth of kochia.

Only one of the interview group indicated that he would likely not use it again as livestock feed.

38. The Purchase or Sale of Kochia as a Forage Crop

In nearly all cases of those interviewed, they had obtained their kochia forage either from their own volunteer stands in saline areas or from neighbors with saline sites growing kochia. The majority of kochia harvested from neighbors sites was offered at no cost other than that of harvesting in order to remove it from the field area.

In a few cases where kochia had been swathed at optimum feed value level, a nominal price had been paid by farmers utilizing it for forage purposes, as in some cases a percentage of cereal grain was present with the kochia crop.

39. Perceived Reasons for Growing Kochia

In nearly all cases kochia was growing on a volunteer basis in saline areas in crop land. Farmers were harvesting it for forage as additional livestock feed but also expecting to stabilize or to reduce the salinity areas they were now dealing with. They also had expectations to reclaim these areas to some reasonable level of cereal production.

40. Farmers Suggestions for Improvement of Kochia as a Forage Crop

Farmers when asked what improvement could be made to kochia to increase its value as a livestock feed indicated:

- need for selection of leafier, less stemmy plant characteristics,

- need to determine reasons for the erratic growth of kochia from year to year,
- need to increase palatability of some kochia stands (stunted, yellow stands are not readily consumed by livestock),
- determine through analysis work if toxic compounds exist at levels detrimental to growth, development and maintenance of livestock,
- investigate its potential as a mixed forage crop grown with other salt tolerant forage such as sweetclover,
- study its ability as a soil improver or ability to stabilize or reverse salt build-up in saline areas,
- research its potential in cropping rotation or development of a favorable environment for permanent grass-legume establishment,
- carry out feeding trials to determine its suitability as a ration component to various classes of livestock,
- determine the practibility of using forage preservatives on kochia (when baling) due to its slow drying characteristics,
- research the relative value of putting up and feeding kochia as silage.

FARMER ATTITUDES TOWARD FURTHER RESEARCH INTO KOCHIA

Farmers who had grown and/or fed kochia ranged from very positive to positive in their support for more research into kochia, both as a forage crop and as a possible assist in dealing with the growing salinity problem.

There is much concern by farmers as they see a gradual increase in saline acres in their cultivated land. They know the frustration they have encountered in trying to crop this area or to establish grass cover on it. Their experience in harvesting and feeding kochia has for the most part been limited and they are wanting more information as to the safety aspect and feeding practices related to it.

FARMERS COMMENTS AND OBSERVATIONS REGARDING KOCHIA

Several farmers growing sweetclover on their saline land expressed concern regarding hemorrhaging they had encountered in feeding it. They are looking at kochia as a possible alternative to this problem. A few farmers who had planted, harvested and fed kochia and clover together had not encountered problems associated with sweetclover alone.

Farmers expressed a desire for more information on all aspects of kochia to provide assurance in the growing, harvesting, and feeding of it.

There is substantial interest in using kochia for summer and fall pasture. At present little or no information is available on it.

If plant selection is undertaken, farmers suggest that careful attention be given to retain kochia's ability to regenerate itself on a volunteer basis.

If some of the present problems associated with kochia can be dealt with, farmers see the possibility of again substantially increasing the livestock base in southern Saskatchewan using kochia to assist in securing an ongoing feed base.

At present a few farmers are feeding chaff and kochia as a wintering ration. Combined with ammoniation of straw or chaff, kochia, plus other available feed supplies, could provide low cost wintering rations that could substantially increase the economic return to the livestock producer.